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**PATENT**

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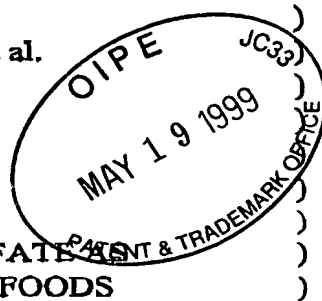
**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:  
CARL J. KNUEVEN et al.

Serial No. 09/131,522

Filed: August 10, 1998

For: SODIUM BISULFATE AS  
ACIDULANT IN FOODS



) Group Art Unit 1761

) Examiner N. Bhat

) Attorney Docket 1-20552  
)

Assistant Commissioner for Patents  
Washington, D. C. 20231

**DECLARATION OF CARL J. KNUEVEN UNDER 37 C.F.R. 1.132**

I, Carl J. Knueven, declare and state that:

1. I am the inventor of the above-captioned patent application. I have read and understand its contents.
2. As a result of my education and employment, I am knowledgeable about sodium bisulfate and about acidulants for use in foods. I received a B.A. Degree in Biology from the University of Toledo in 1981, and an M.S. Degree in Chemistry from Bowling Green State University in 1994. I have been employed with the Jones-Hamilton Company for the past sixteen years. During the last three years, I have been the Manager of Technical Services and Research Development, doing research on new uses of sodium bisulfate. One of the new uses is the use of sodium bisulfate as an acidulant in foods. During the previous thirteen years, I worked in the technical services area relating to existing or new uses for sodium bisulfate.

3. Under my supervision, a study was conducted in which the flavor profile of sodium bisulfate was compared with the flavor profiles of citric acid, malic acid and phosphoric acid.

Methodology:

Seven samples of sodium bisulfate, and three samples each of citric acid, malic acid and phosphoric acid were preweighed in separate plastic vials. Each sample was brought up to two liters volume using spring water and mixed thoroughly. The samples were evaluated by flavor experts who were trained and experienced in detailed flavor analysis. A flavor spectrum of the predominant attributes was developed (see the attached Appendix A for definitions of terminology). The strength of each attribute was rated on a 0 - 15 point intensity scale with 0 = none and 15 = very strong.

Results:

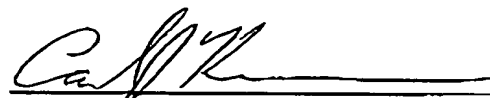
The intensity values for the flavor attributes are shown in the attached Table 1. A graph of sour intensity versus concentration is also attached. The results show that the sodium bisulfate sour intensity linearly increased with concentration. The sodium bisulfate had a steeper slope than the citric acid, malic acid and phosphoric acid. At the lowest concentration (0.92g/2L) the sodium bisulfate was slightly less sour than the citric acid, but at the higher concentrations (greater than 2.12g/2L) it was higher in sour intensity compared to all three organic acids tested (citric, malic, phosphoric). The sodium bisulfate had no aromatics present within the range tested. Aromatics are flavor notes detected in the oral cavity other than the basic tastes. The sodium bisulfate was slightly astringent at the lower concentrations and increased to moderate astringency at the highest concentration. It was no higher in astringency than the citric acid or phosphoric acid but it was higher than the malic acid. The sodium bisulfate also had a slight metallic feeling factor that was not present in citric acid but was present in the malic and phosphoric acids.

The main difference between the sodium bisulfate and the three organic acids was the slope of the sour intensity curve. The sodium bisulfate astringency also

lasted longer than the astringency of the citric acid. It lasted up to a minute after expectoration whereas the organic acids rinsed clean within a 30 second window. The sodium bisulfate also caused a slight oral irritation at the higher levels that was associated with the metallic mouthfeel. Other than these two attributes, the sodium bisulfate gave a clean mouthfeel and compared with the phosphoric acid and malic acid as having similar metallic mouthfeel properties in a water solution. The results also showed that in a water solution, it will take slightly more sodium bisulfate at low concentrations and considerably less sodium bisulfate at higher concentrations to impart the same sour intensity as citric acid, malic acid, or phosphoric acid.

4. All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true.

5. These statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the patent application and any patent resulting therefrom.

  
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Carl J. Knueven  
Date: 5/14/99

## **APPENDIX A**

### **DEFINITIONS OF FLAVOR TERMINOLOGY**

#### **BASIC TASTES**

<b>Sweet</b>	The taste on the tongue stimulated by sucrose and other sugars, such as fructose, glucose, etc., and by other sweet substances, such as saccharin, Aspartame and Acesulfam-K.
<b>Sour</b>	The taste on the tongue stimulated by acids, such as citric, malic, phosphoric, etc.
<b>Bitter</b>	The taste on the tongue stimulated by substances such as quinine, caffeine and hop bitters.

#### **CHEMICAL FEELING FACTORS**

<b>Astringent</b>	The shrinking or puckering of the tongue surface caused by substances such as tannins or alum.
<b>Metallic</b>	The metallic/tinny sensation in the mouth.

Table 1 - Flavor Profile  
Jones-Hamilton Acidulant Study

Sample code	Sodium Bisulfate										Phosphoric Acid			Citric Acid			Malic Acid		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Conc. (g/2L)	0.92	1.32	1.72	2.12	2.52	2.92	3.32	0.92	2.12	3.32	0.92	2.12	3.32	0.92	2.12	3.32			
Aromatics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Sweet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Sour	3.3	5.5	9	11	12	14.5	17	3	8	12	4	8	12	2.5	7	12			
Bitter	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1.5	1.5			
Astringent	2.5	4.5	5	5	5.5	7	7	2.5	5	7	2.5	5.5	6.5	2	3	4.5			
metallic	0	0	2.5	2.5	1	1.5	3	1.5	2	4	0	0	0	2	2	3			

Scale was 15 points where 0=none and 15=extreme intensity

Sodium Bisulfate had astringency that lasted longer in the mouth after expectoration than with the standard citric acid

Sodium Bisulfate had a slight oral irritation at some levels that was linked to the metallic mouthfeel

Sodium Bisulfate Compared to other Acidulants

